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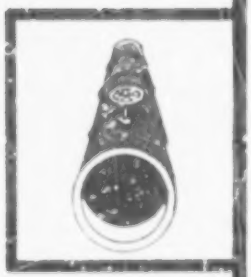

NATIONAL TRANSPORTATION SAFETY BOARD

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WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

DERAILMENT OF
NEW YORK CITY TRANSIT AUTHORITY
SUBWAY TRAIN
DEKALB AVENUE STATION
BROOKLYN, NEW YORK
MAY 15, 1985

NTSB/RAR-86/01

UNITED STATES GOVERNMENT

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15. Supplementary Notes

16. Abstract

At 10:11 a.m. on May 15, 1985, a New York City Transit Authority southbound eight-car subway train derailed moments after departing the DeKalb Avenue Station, Brooklyn, New York. The train had made a station stop, proceeded out of the station, and then entered a track crossover section. The first car entered the crossover, but the second car derailed at the left-hand switch, continued in a derailed condition for about 120 feet, and struck a concrete-and-steel track separation wall. The right side of the derailed car struck the wall at the unoccupied conductor's cab and severed 20 feet of the car side. The third rail was damaged for approximately 40 feet, and the third-rail wooden cover board was forced up under the derailed car. Dense smoke resulted when arcing of the damaged third rail caused a fire in the cover board and the wiring insulation on the car.

An attempt was made to restore rail service on the tracks not involved in the accident, 1 hour 7 minutes after the derailment by restoring the third-rail power to the northbound tracks. However, a series of explosions occurred under the derailed car when the third rail at the accident site became energized. Forty-nine passengers and 7 employees were treated for smoke inhalation by the emergency medical services, and 16 passengers were treated at local hospitals. Damage was estimated to be $400,000.

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Abstract (continued)

The National Transportation Safety Board determines that the probable cause of this accident was the New York City Transit Authority's failure to supervise properly the employees replacing rails and adjusting signals to require that the replacement of the rails was in conformity with NYCTA procedures. Contributing to the scope of the accident was the NYCTA's failure to supervise an unqualified power maintainer while restoring third-rail power, which resulted in an inadvertent energizing of the third rail at the accident site before the emergency was over and subsequent third-rail power removal which caused the stopping and evacuation of 16 additional trains.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: March 27, 1986

DERAILMENT OF NEW YORK CITY TRANSIT AUTHORITY SUBWAY TRAIN DEKALB AVENUE STATION BROOKLYN, NEW YORK MAY 15, 1985

SYNOPSIS

At 10:11 a.m. on May 15. 1985, a New York City Transit Authority southbound eight-car subway train derailed moments after departing the DeKalb Avenue Station, Brooklyn, New York. The train had made a station stop, proceeded out of the station, and then entered a track crossover section. The first car entered the crossover, but the second car derailed at the left-hand switch, continued in a derailed condition for about 120 feet, and struck a concrete-and-steel track separation wall. The right side of the derailed car struck the wall at the unoccupied conductor's cab and severed 20 feet of the car side. The third rail was damaged for approximately 40 feet, and the third-rail wooden cover board was forced up under the derailed car. Dense smoke resulted when arcing of the damaged third rail caused a fire in the cover board and the wiring insulation on the car.

An attempt was made to restore rail service on the tracks not involved in the accident 1 hour 7 minutes after the derailment by restoring the third-rail power to the northbound tracks. However, a series of explosions occurred under the derailed car when the third rail at the accident site became energized. Forty-nine passengers and 7 employees were treated for smoke inhalation by the emergency medical services, and 16 passengers were treated at local hospitals. Damage was estimated to be $400,000.

The National Transportation Safety Board determines that the probable cause of this accident was the New York City Transit Authority's failure to supervise properly the employees replacing rails and adjusting signals to require that the replacement of the rails was in conformity with NYCTA procedures. Contributing to the scope of the accident was the NYCTA's failure to supervise an unqualified power maintainer while restoring third-rail power, which resulted in an inadvertent energizing of the third rail at the accident site before the emergency was over and subsequent third-rail power removal which caused the stopping and evacuation of 16 additional trains.

INVESTIGATION

The Accident

Between midnight and 4:45 a.m. on May 15, 1985, a crew, consisting of a line supervisor and 20 track employees from the New York City Transit Authority (NYCTA) capital improvement division, performed track work in the crossover between track Nos. A3 and F1 just south of the DeKalb Avenue Station. The work included replacement

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of a right-hand switch point with an 18-foot-long Sampson switch point, a stock rail with a new Sampson stock rail, and older worn 100-pound rail with new 100-pound ARA-B rail. The tie plates and the west stock rail braces were reused. The line supervisor stated that three stock rail braces were missing when the crew stripped the old rails and that new ones had not been left at the job site for their use.

A signal maintainer and two helpers also were at the rail replacement site. The signal maintainer stated that he made all the necessary adjustments to the switch machine and signal system at the crossover location.

The line supervisor stated that he inspected the track and took no exception and that just before leaving the site at 4:45 a.m., he advised a track maintenance department foreman, who was working farther north on the track, that the crew had performed the necessary repairs. The track maintenance department foreman released the track for train service at 5 a.m. A deputy superintendent of the capital improvement division stated that he inspected the track work about 5:15 a.m. and that he took no exception to the work.

Between 5 a.m. and 7:24 a.m., before the crossover of trains was suspended for rush hour service, 11 trains used the crossover. During rush hour, 7:30 a.m. to 10 a.m., 23 trains proceeded straight on track No. A3.

About 10:11 a.m., the 8:59 a.m. NYCTA southbound subway train on the N line from Continental Avenue in Queens to Stillwell Avenue in Brooklyn departed the DeKalb Avenue Station after making a regular station stop. The train consisted of eight cars which were loaded with about 150 passengers. The train's next scheduled stop was to be the Pacific Street Station in Brooklyn. The train was on track No. A3 departing DeKalb Avenue Station and was routed to track No. F1 through a crossover about 150 feet south of the DeKalb Avenue Station. The 8:59 a.m. train was the first train to be crossed over at the switch after the rush hour. (See figure 1.)

The operator stated that he accelerated to about 8 mph after departing the DeKalb Avenue Station and that the signal indicated the train would diverge when it entered the switch of the crossover. The first car passed through the switch and entered the crossover, but the second car derailed at the switch. As the train continued 120 feet forward, the derailed car moved away from the track structure and struck a concrete-and-steel track separation wall. (See figure 2.) The train operator stated that he was not aware of the train derailment until he heard an unusual noise, the train came to a stop, and he saw smoke coming from under the train. At that time, the train operator notified the NYCTA command center of the derailment.

The command center instructed the train operator to direct passengers to the rear cars, which were still in the DeKalb Avenue Station, to allow them to exit to the station platform. However, the train operator could not pass from the first car to the second car, because the car end doors had been misaligned during the derailment and the second car was damaged. The train operator returned to the operating cab and notified the command center that he could not enter the rear cars and that there were nine passengers and an infant in the first car with him. The train operator then detrained and walked toward the rear of the train to assess the damage. He then left the area on instructions of NYCTA supervisors and proceeded to the second level of the DeKalb Station. The train operator stated that he could not make a decision to evacuate passengers and that only the NYCTA command center or supervisors could make that decision.

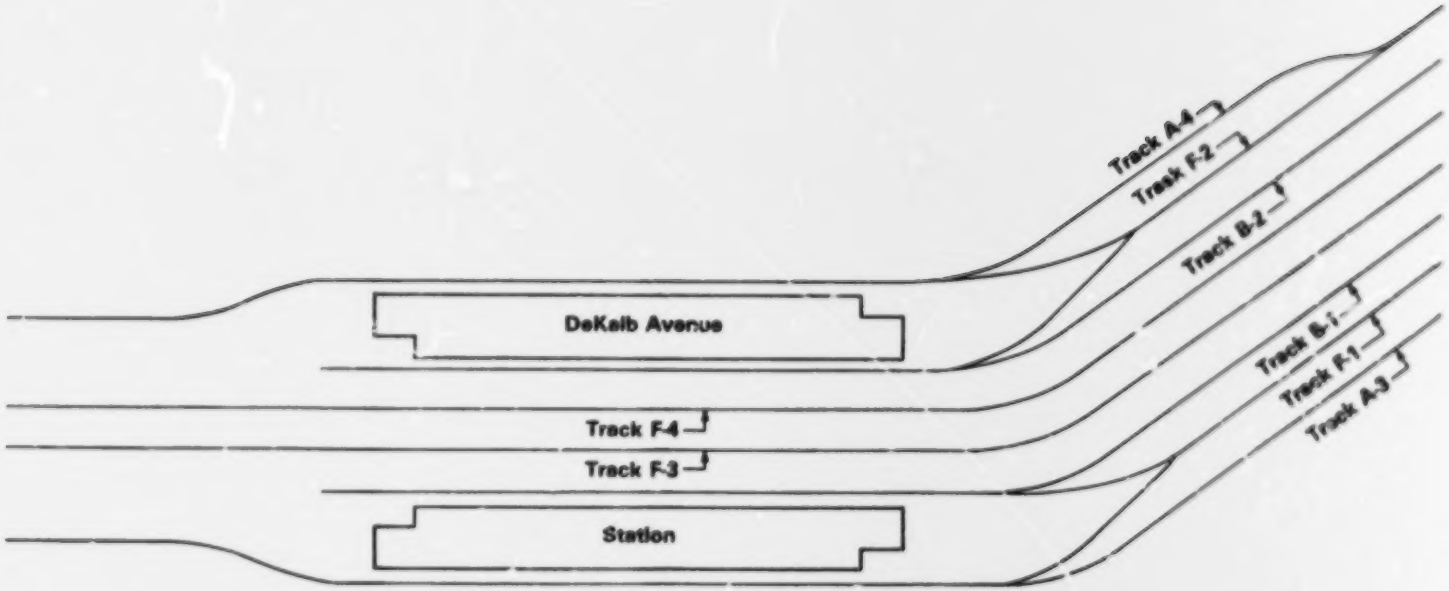

Figure 1.--Station and track diagram.

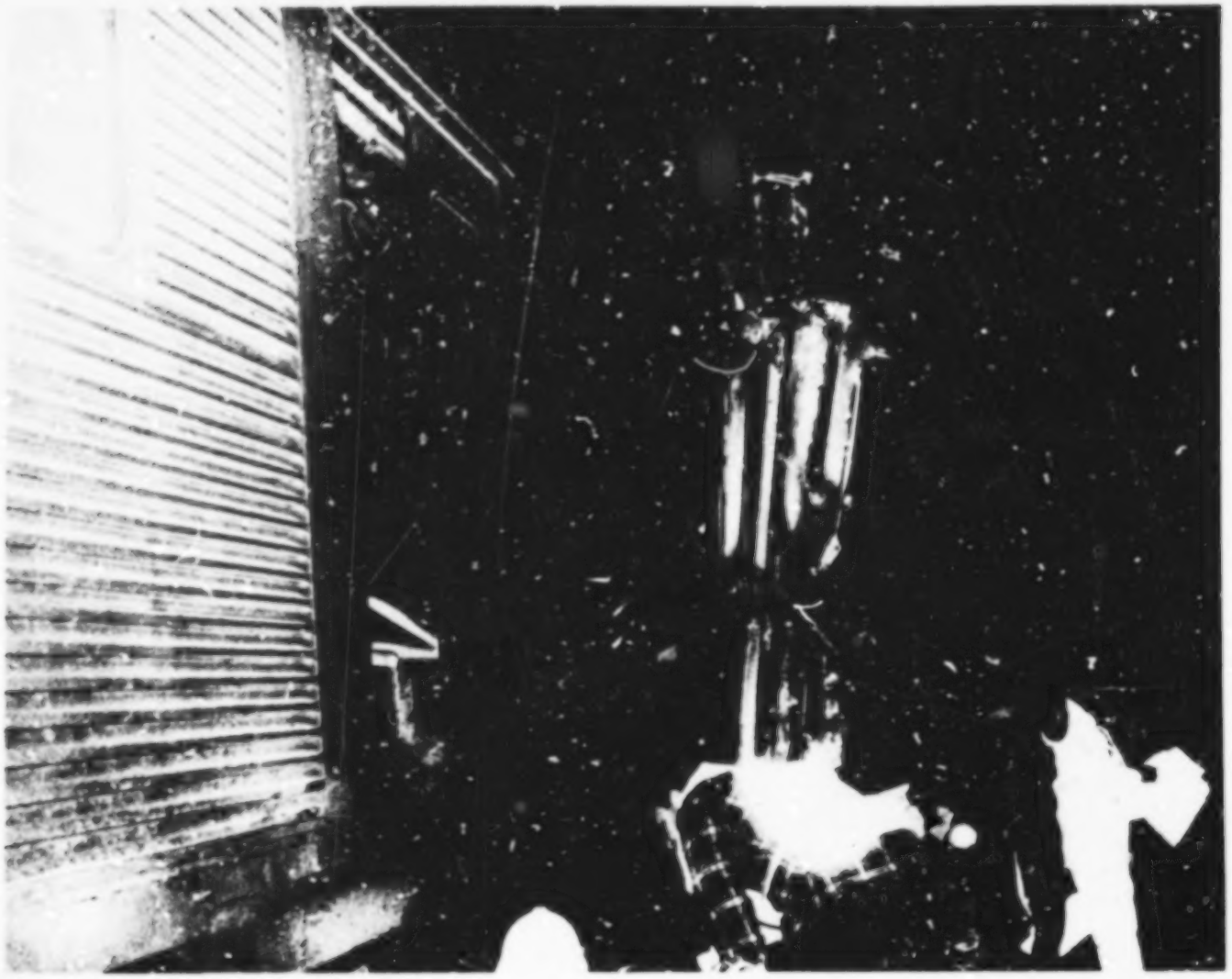

Figure 2.--Second car of train against track separation wall.

A student conductor, who was located in the conductor's cab, and the train's conductor, who was in the passenger section of the fourth car, said that they were not aware that the train had derailed. The public address system was not operating due to damage sustained by the second car during the derailment, and conductors are not furnished radios. Passengers who were proceeding from the forward cars told the train's conductor that smoke was in the forward cars. The conductor then proceeded to the second car. He said that as he entered the second car he felt the floor was sloping up and that he was unable to progress to the forward door of the second car because of the heavy smoke and limited visibility. The conductor returned to the rear of the train where he directed the discharge of passengers from the rear seven cars onto the DeKalb Avenue Station platform.

The New York Fire Department (NYFD) was notified by the NYCTA command center at 10:15 a.m. and arrived on scene at 10:20 a.m. Firefighters immediately began to assist in the evacuation of passengers and to extinguish the fire.

Meanwhile, NYCTA employees had arrived on scene and were attempting to reach the front of the train. NYCTA employees found that the derailed second car had struck and extensively damaged the third rail, and that the wooden protective cover board of the third rail had been torn loose and pushed up under the car where it was ignited by electrical arcing of the damaged third rail, causing explosions and smoke under the car. NYCTA employees instructed the operator at the DeKalb Avenue Tower to shut down the third-rail power. At 10:21 a.m., the DeKalb Avenue Tower activated emergency alarm box No. 141 1/ which shut down power to the third rail. The power had been on a sufficient length of time so that trains could enter stations. NYCTA employees then entered the front end door of the first car in the train and evacuated the passengers who were instructed to walk forward along the tracks to the Pacific Street Station. All passengers were evacuated from the train by 10:42 a.m. By 11:06 a.m., the fire had been extinguished and NYFD personnel had left the track area.

Shortly afterward, the NYCTA command center instructed the NYCTA power department to restore third-rail power to the northbound tracks so that train service could resume. The power department instructed the power maintainer at the Hudson substation to restore the power. However, when power was restored at 11:18 a.m., explosions again occurred under the derailed car. NYCTA personnel at the accident scene notified the command center and requested that the third-rail power be removed immediately. Power again was removed from the third rail by activating emergency alarm box No. 141.

Sixteen trains, which were loaded with about 2,000 passengers, were stalled in the power-off section when the power was removed from the third rail the second time. Ten trains were in stations where passengers could be discharged, 5 trains were stopped in tunnels, and 1 train was stranded on the Manhattan Bridge. NYFD and NYCTA personnel were dispatched immediately to the stranded trains to evacuate passengers, and the NYCTA command center broadcast to trains via the public address system information regarding the power-out emergency. All passengers were evacuated from the stranded trains by 12:40 p.m. Sixteen persons from the derailed train were transported to area hospitals, where all but two were treated for smoke inhalation and released.

1/ When emergency alarm box No. 141 is activated, loss of third-rail power affects an area approximately 3 1/2 miles involving 10 tracks.

Injuries to Persons

Injuries	NYCTA Employees	Passengers	Total
Fatal	0	0	0
Minor	7	65	72
None	0	85	85
Total	7	150	157

Damage

As a result of the impact with the track separation wall, 20 feet of the right sidewall of the derailed second car was torn and wedged between the car and the wall. The right-front corner of the car was crushed, and the roof was buckled 6 inches downward. The floor of the car was buckled 2 feet upward. Seats along the portion of the torn side wall were destroyed. (See figure 3.) Damage to the car was extensive, beyond repair, and estimated at $350,000. Damage to track and signal equipment was estimated at $50,000.

Personnel Information

The crew of the subway train consisted of a train operator, a conductor, and a student conductor who was working on the train to learn the route. All were qualified under NYCTA rules without restrictions. (See appendix B.) However, the train operator had not been to the NYCTA school for firefighting. 2/

The line supervisor (track supervisor) of the capital improvement division had attended the NYCTA Track School for 3 months which included classroom and on-the-job training. He had worked as a line supervisor for 6 years but had not received any recurrent training or refresher courses; however, he was qualified under NYCTA rules without restrictions. The line supervisor was qualified and required to make track inspections.

The deputy superintendent of the capital improvement division had worked for the NYCTA for 11 1/2 years; he had worked 7 years as a track worker. He was promoted to track foreman and attended NYCTA track school for 3 months which included classroom and on-the-job training. He had worked 4 years as a track foreman, and 4 months as deputy superintendent with no additional training given. He had not received any recurrent training. The deputy superintendent was qualified under NYCTA rules without restrictions, and he was qualified and required to make track inspections.

The signal maintainer had been working for the NYCTA for 11 years. He had worked as a signal helper for 8 years and then successfully passed a civil service examination for the position of signal maintainer. Following the examination, the signal maintainer attended NYCTA classroom training for signal maintainers for 3 months and then spent 3 months on the job as a trainee, followed by a 3-year probation period which he had just completed at the time of the accident.

2/ Consists of 4 hours of classroom instruction, which includes the criteria for train evacuation. The classroom session is followed by practice emergency drills in extinguishing fires and train evacuation in simulated conditions.

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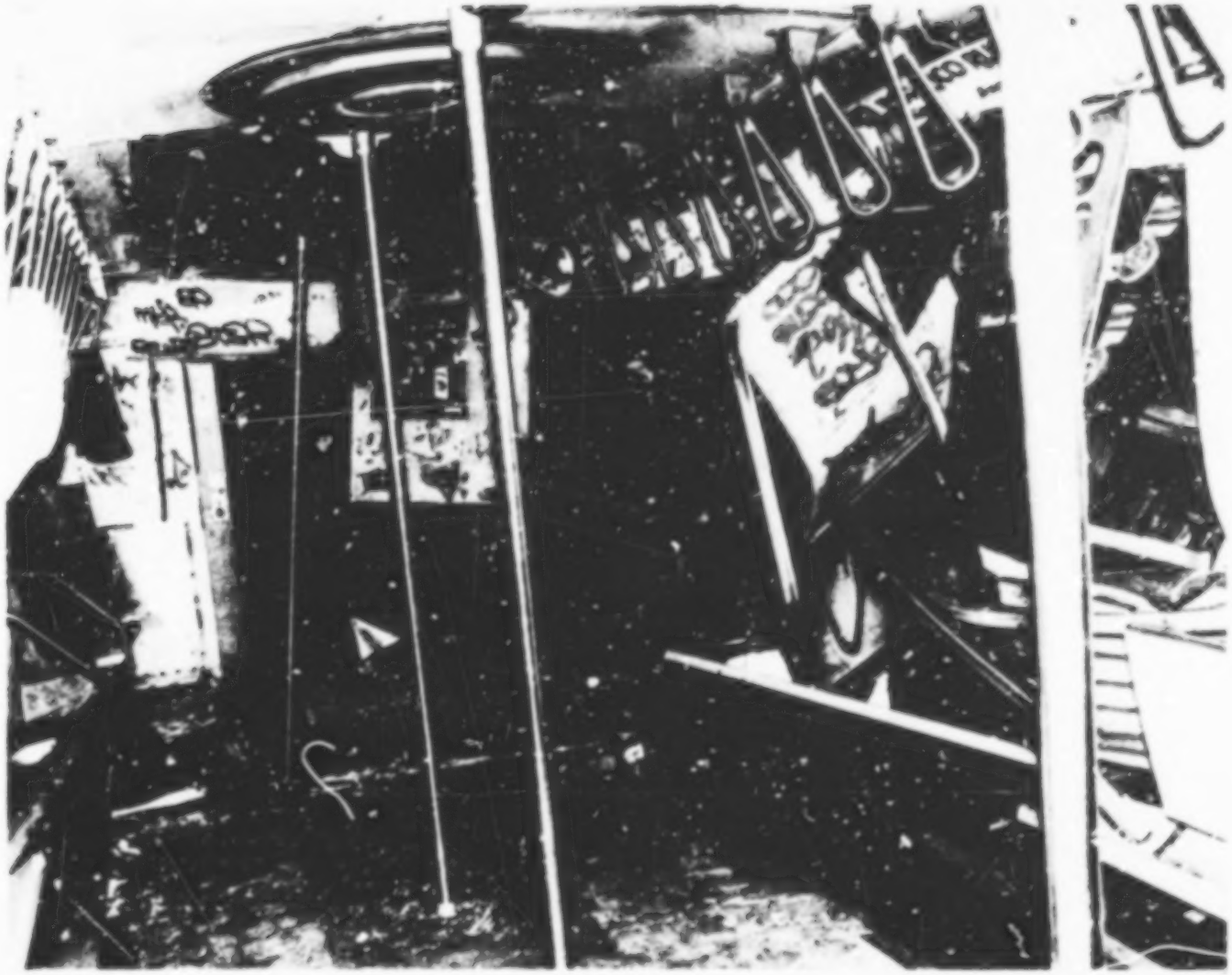

Figure 3.--Extensively damaged second car in train.

On the day of the accident, the signal maintainer was working in a relief assignment and had been assigned to work at DeKalb Avenue; however, on other days, he was assigned to work at other locations, including Coney Island Yard and Prospect Park. He had been working the relief assignment for 2 years. He was qualified by NYCTA rules.

The power maintainer had worked 11 years as a power maintainer helper; however, all of his experience as a helper had been at automated substations with duties of cleaning and adjusting equipment. When the power maintainer took the civil service examination for the position of power maintainer, he failed. Because of his lack of experience as a helper in manual substations, he could not answer questions on the examination that pertained to manually-operated substations. After failing the examination a second time, the power maintainer asked questions and obtained some equipment manufacturers' materials to study. He successfully passed the examination on the third try without any practical experience or training on the operation of manually-operated substations.

During the following 18 months, the power maintainer received on-the-job training from power department foremen at four substations. However, because the foreman at the Hudson substation was not working due to an off-duty accident, his training was provided by power maintainers on the job. This on-the-job training was not structured but consisted in observing the on-duty power maintainer perform his duties. Also, it was not consistent. Because of the man power shortage in the power department, the power maintainer had to alternate between filling vacant power maintainer positions until he was no longer required and training as a power maintainer trainee. Such practice had existed at the Hudson substation for 5 months preceding this accident. The power maintainer stated that he was not qualified to work the Hudson substation and had not signed the required form indicating that he was qualified.

The assistant supervisor of the NYCTA power department was qualified under NYCTA rules without restrictions. He had about 30 years' experience in the power department and had worked at the Hudson substation as a power maintainer.

Train Information

The train consisted of eight R-32 type, self-propelled electric subway cars with four-wheel trucks, which were built in 1965 by the Budd Car Company. The R-32 type car is 60 feet 2 1/2 inches long and weighs 69,562 pounds. Traction power is carried from the third rail through a current collector shoe on each truck. The cars are operated in pairs as a unit, and the pairs can be operated in multiples. End doors on each car permit passengers to move from one car to another, and eight sets of double doors, four on each side, permit passengers to enter and exit from the car to station platforms.

Each car is equipped with an operating cab on one end and a conductor's cab on the opposite end. The operating cab contains a brake valve and a master controller. The brake system uses both dynamic and electropneumatic blended braking and is controlled by the train operator with the brake handle. The master controller regulates the speed of the train. The master controller handle must be depressed while the train is moving under power; otherwise, the "deadman" feature will apply full emergency brakes.

There are no speed indicators on NYCTA cars of the R-32 series; however, there is a speed tripper system that prevents overspeed operations. The train operator stated that he controls speed from experience gained through operating trains and the sights and sounds as the train moves along the track. The operating cab also contains a radio, which

is used to communicate with the command center, wayside radios, and other trains, and a microphone that allows the train operator to make announcements throughout the train and to communicate with the conductor. The conductor's cab contains a master door control panel which operates the side doors of the train, a microphone that allows the conductor to make announcements throughout the train and to communicate with the train operator, heat and light control switches, and a button to operate a buzzer system which is used to communicate with the train operator.

At the time of the derailment, two sealed-beam headlights, the two lights adjacent to the illuminated route number and destination sign on the lead car, and four red rear lights on the last car in the train were illuminated.

The derailed car was equipped with General Electric "SCM" controllers and was assigned to the Coney Island maintenance terminal. The last scheduled maintenance was performed on April 4, 1985, at which time the car had accumulated 1,030,937 miles. At the time of the derailment, the car had accumulated a total of 1,037,299 miles, or 6,362 miles since the last regularly scheduled maintenance.

The postaccident inspection disclosed that the wheel flanges on all of the train's car wheels except one were normal. The flange of the No. 7 wheel on the derailed second car (the lead wheel of the second car and the first wheel to derail) was worn to a flat surface that was approximately 1/8 inch lower then the mate wheel on the axle. (See figure 4. Sketch C shows the unusual wheel wear found on the first wheel that derailed in this accident, sketch A shows a new wheel contour, sketch B shows the normal area of wheel wear, and sketch D shows a wheel with normal wear.) The cast-iron brake shoe at the No. 7 wheel location was worn down to the backing plate. The brake rigging, which was holding the brake shoe against the wheel, could not be removed; the brake rigging was dismantled to remove the brake shoe because the rigging was distorted. There was no indication that this condition was caused by the derailment. However, the wheel tolerances were within NYCTA maintenance standards.

When rail wheels are inspected, the flange of the wheel is checked to determine if, through wear, it is thin, vertical, or high. (See figure 5.) The NYCTA has no minimum height requirements for a wheel flange nor a minimum radius that has to be maintained for it to continue in service.

Track Information

The train derailed on the crossover between tracks Nos. A3 and F1. The grade at the accident location was 0.5 percent descending, and the crossover is designated as southbound. The track is classified by the NYCTA as Design Type 11 modified with wood tie blocks embedded in a concrete invert.

The track work on the NYCTA is performed by two divisions within the Track and Structures Department. The track maintenance division maintains the existing track and replaces tracks that no longer can be maintained in a safe condition. The track construction division replaces track programmed on the annual fiscal capital schedule.

The track work performed on the day of the accident had not been planned into the fiscal capital schedule, but the track maintenance division had determined rails needed to be replaced because of wear. The track maintence division had arranged for the material delivery and had scheduled the work. However, because the track maintenance division did not have sufficient trackmen, supervisors, or time to replace the switch point and

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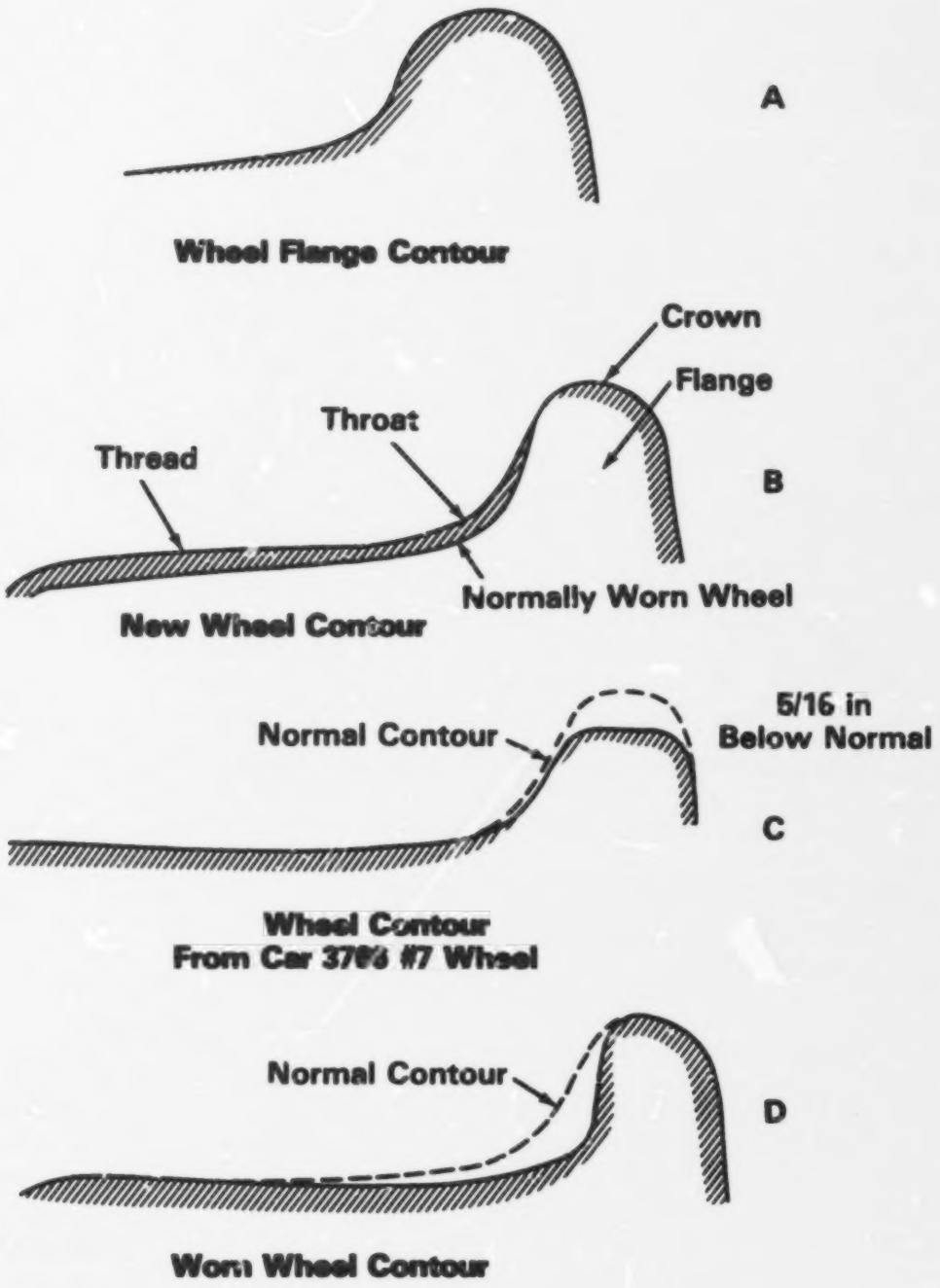

Figure 4.--Wheel flange wear on second car.

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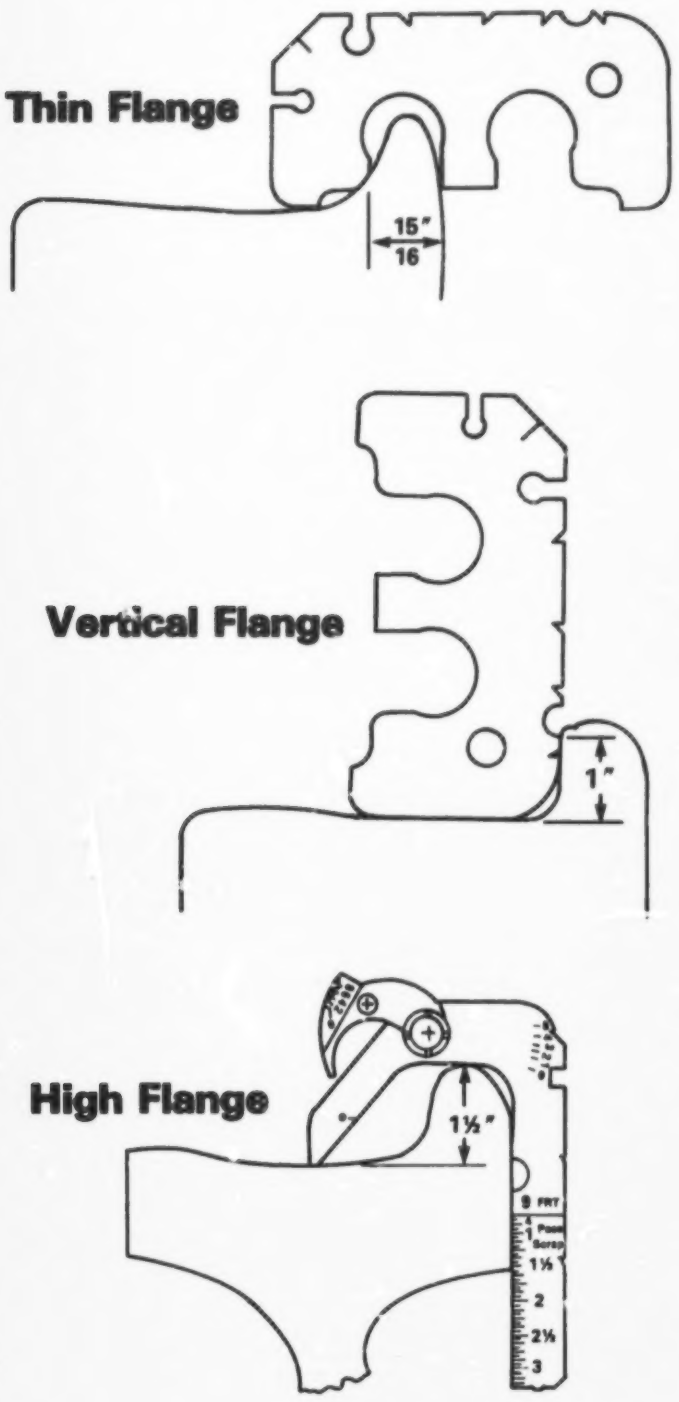

Figure 5.--Gauging of wheels when inspected.

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stock rail, it had requested that the capital improvement division perform the work. The track maintenance division contacted the command center and requested and received the general order for taking the track out of service so that the replacement could be accomplished.

Following a major track replacement, such as the track work done on May 15, 1985, NYCTA rules require (1) that the track be inspected at the end of the work period, (2) that the command center be advised that the work is completed for the day and that the track is available for service as provided by the general order, and (3) that [a supervisor] observe the first revenue train as it safely passes over the completed work. However,the NYCTA Chief Engineer Track and Structures stated:

> I don't believe in having a strict requirement that the first train be observed on every job regardless of the scope of job or anything like that; however, in this case, I do think it would have been prudent for someone to have checked one of the first several trains that go through there, just to make sure that nothing--that mill scale didn't come loose and loosen something up. or that something was caught or cocked and worked itself loose under the first train. I think it would have been prudent.

Both the capital improvement division line supervisor and the deputy superintendent stated that they each inspected the finished work and took no exception. The line supervisor stated that he did not release the track to service, following the track replacement, because he believed that since the track maintenance division had obtained the general order, it was that division's responsibility to release the track. He said that he reported to the track maintenance division foreman that the replacement work performed by the capital improvement forces was completed and that he and the crew left the work site before the first train passed through. The track maintenance division foreman said that he was busy at his work site and could not be at the switch location when the first train passed over the track.

The capital improvement division line supervisor did not have a standard track gauge needed to properly align and gauge rails. He stated that he had left it at the starting location and that it was not his usual practice to gauge and align rails that had been replaced by his forces. He further stated that those functions were generally the responsibility of the track maintenance division. The track and structures department management advised that it was the duty of the foreman doing the work to do all the gauging and aligning of the track as the work is performed.

The Chief Engineer Track and Structures stated:

> The work was scoped out by maintenance, the sketches were drawn, the rails measured, delivered and so forth, and essentially the scope was quite simple. There were two nights of work to install the material that was on the site. As to whether they had a responsibility for assuring that the work was done to their satisfaction, methods and standards-wise, that is problematical.

He described the capital improvement work force that performed this work as "essentially a labor contractor coming in and helping out."

The postaccident inspection of the track revealed that:

- the No. 1 switch rod was slightly bowed;
- lateral movement was present on the west clips of the Nos. 1, 2, 3, and 4 switch rods;
- the holddown track spikes were missing from the gauge side of the No. 1 tie S-plate on the west rail;
- the west switch point was blunt as a result of having been struck (see figure 6);
- the west stock rail was sitting on top of the tie plate risers;
- all west stock rail braces were improperly secured (see figure 7);
- the normal (east) switch point throw was 3 3/4 inches; and
- the reverse (west) switch point throw was 4 inches.

NYCTA personnel straightened the Nos. 1, 3, and 4 switch rods damaged in the derailment and tightened the loose stock rail braces. The switch machine was cranked manually to the reversed position and locked. An opening of 7/16 inch was measured between the switch point and stock rail. The switch point could be forced open an additional 1/8 inch because of the lateral movement in the switch rod clips.

The west stock rail was placed in its proper position after the stock rail braces were removed and the missing track spikes were installed in the No. 1 tie S-plate. The switch throw of the west switch point measured 4 1/4 inches; however, the switch point could not be adjusted to the 4 1/4-inch limit because this limit was beyond the switch machine travel.

The Chief Engineer Track and Structures identified a problem of seating new stock rail in existing tie plates; even if the tie plates are in good shape, the tie plates tend not to lie level and uniform due to the wear and tear from years of service with trains operating on the track. However, the existing manuals and books of standards for track work do not adequately point out the need for attention to the stock rail being seated. The Chief Engineer Track and Structures stated that a new manual for track work which was being prepared included instructions that stock rails must be seated properly.

The third rail is energized at 600 volts d.c. and is distributed throughout the system by substations located throughout the system. A system operator located at the central power operations center controls the distribution of the electrical power through automatic substations and manually-operated substations. Automatic substations are operated from the central power operations center by a power maintainer working with the system operator. The system operator orders the opening and closing of the switches at the automatic substation to meet the demands of the system. A power maintainer is on duty at each manually operated substation. The power maintainer receives all instructions for opening or closing of switches from the system operator by telephone.

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Figure 6.--Damaged switch point.

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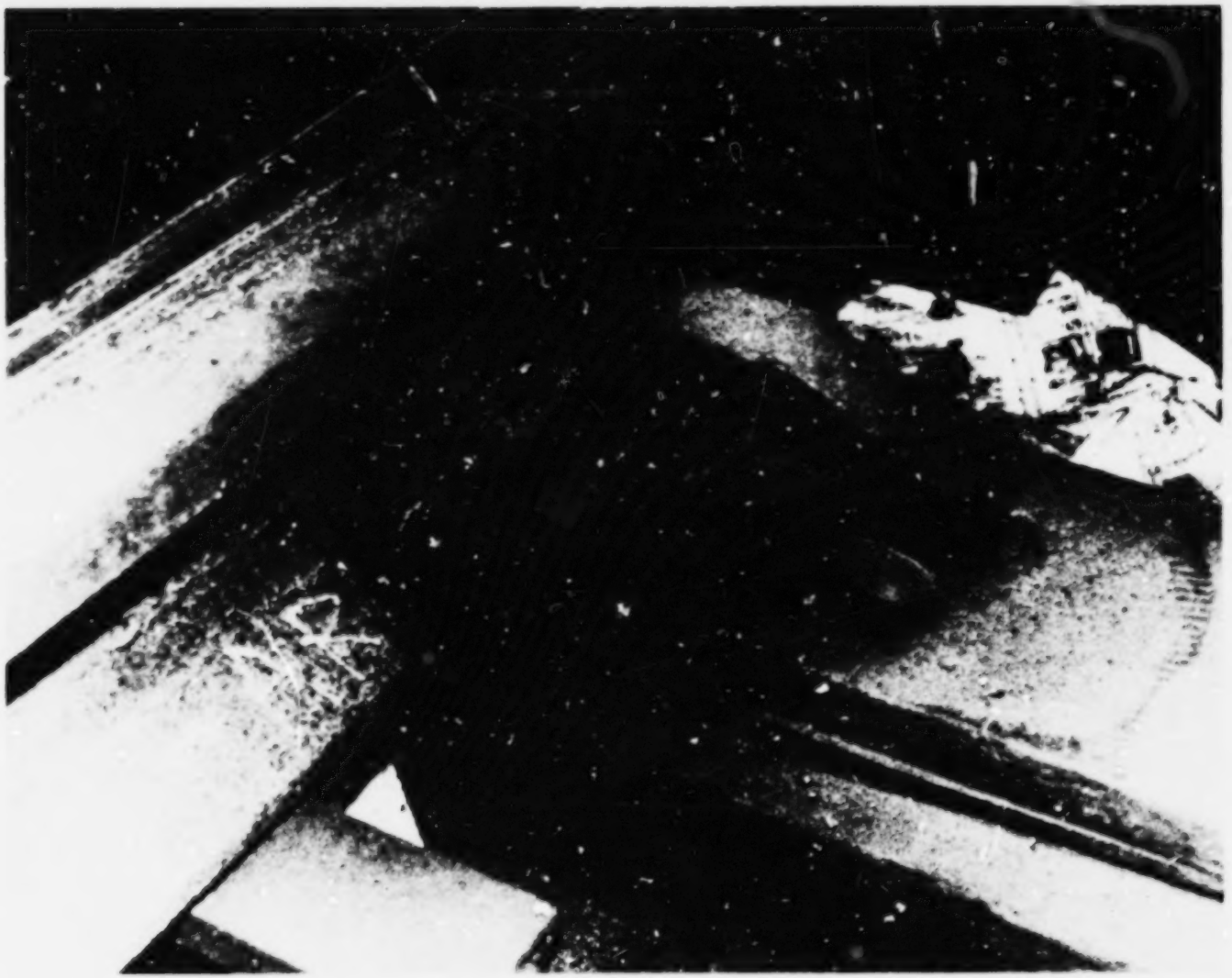

Figure 7.--Loose stock rail braces.

The Hudson substation is a power distribution point. All 600-volt power is sent from other substations and then sent out to various tracks from the Hudson substation. (See figure 8.) It is also a manually-operated station with a power maintainer on duty. When the train derailed at 10:11 a.m., a breaker to track F1 opened, causing the breaker to be damaged and unusable until it could be repaired. The power department instructed the power maintainer at Hudson substation to close the auxiliary breaker and the switch on track F1 on the transfer bus to check for a direct short. At 10:21 a.m., the 600-volt power was shut off when the emergency alarm box was activated. This removed the third-rail 600-volt power from the Hudson substation (see figure 9). Neither the power department nor the power maintainer knew that a derailment had occurred.

At 11 a.m. the power maintainer was relieved by another power maintainer, while the 600-volt third-rail power was still off. The power maintainer being relieved at 11 a.m. had failed to open the auxiliary breaker and the transfer bus switch, and he did not tell the power maintainer coming on duty that they were still closed.

Only two power maintainers were assigned to the Hudson substation because of a shortage of qualified maintainers. As a result, each power maintainer was working a 12-hour shift. The Power Department, Director of Operations-Power advised that a shortage of qualified maintainers occured from "time to time in the Hudson substation." Because of the heavy workload at the substation, a foreman normally was assigned to duty during the day shift. However, the foreman assigned to the station had been involved in an off-duty accident which had disabled him for several months, and the foreman position had not been filled. Full time foremen from other stations were required to make spot checks at the Hudson substation in addition to their regular assignments. The Assistant Supervisor advised that the power department was very short of personnel, and employees being off sick and on vacations added to the shortage.

The power maintainer who came on duty at 11 a.m. was working a relief position, and his assignment required him to work at six different substations. When he reported for duty, an assistant supervisor accompanied the power maintainer as he checked out the position of switches and the status of the loss of power at the substation. The assistant supervisor explained to the maintainer that an overload had damaged the breaker for track No. F1 and that the auxiliary breaker had been closed so that it could be available for restoring power; however, the knife switch was left in the open position. The power maintainer learned that a train had derailed and that was the reason for the power shutdown. The system operator called the power maintainer at 11:18 a.m. and instructed him to restore power, which had been off since the derailment, to the undamaged tracks and designated the switches to be closed; the assistant supervisor only watched through the window as the power maintainer went to close the switches. The assistant supervisor said that he did not see the power maintainer close the switches because he could not see the power board from that position. The power maintainer closed the switches as instructed to energize all the undamaged tracks but did not open the auxiliary breaker because the knife switch was open. The system operator said that he only intended to energize the third rail to track No. A4 and all the other undamaged tracks for train movements, and that the switches he instructed the power maintainer to close would have accomplished that task. However, the auxiliary breaker which had been closed by the previous maintainer had a test resistance loop built into the system around the knife switch which allowed the 600-volt power to bypass the knife switch and energize the third rail at the accident site. (See figure 10.)

The power maintainer stated that he was not aware nor had he been instructed that the test resistance loop was present on the auxiliary breaker. In addition, the schematic drawing, on the front of the panel showing the test resistance loop, was worn and

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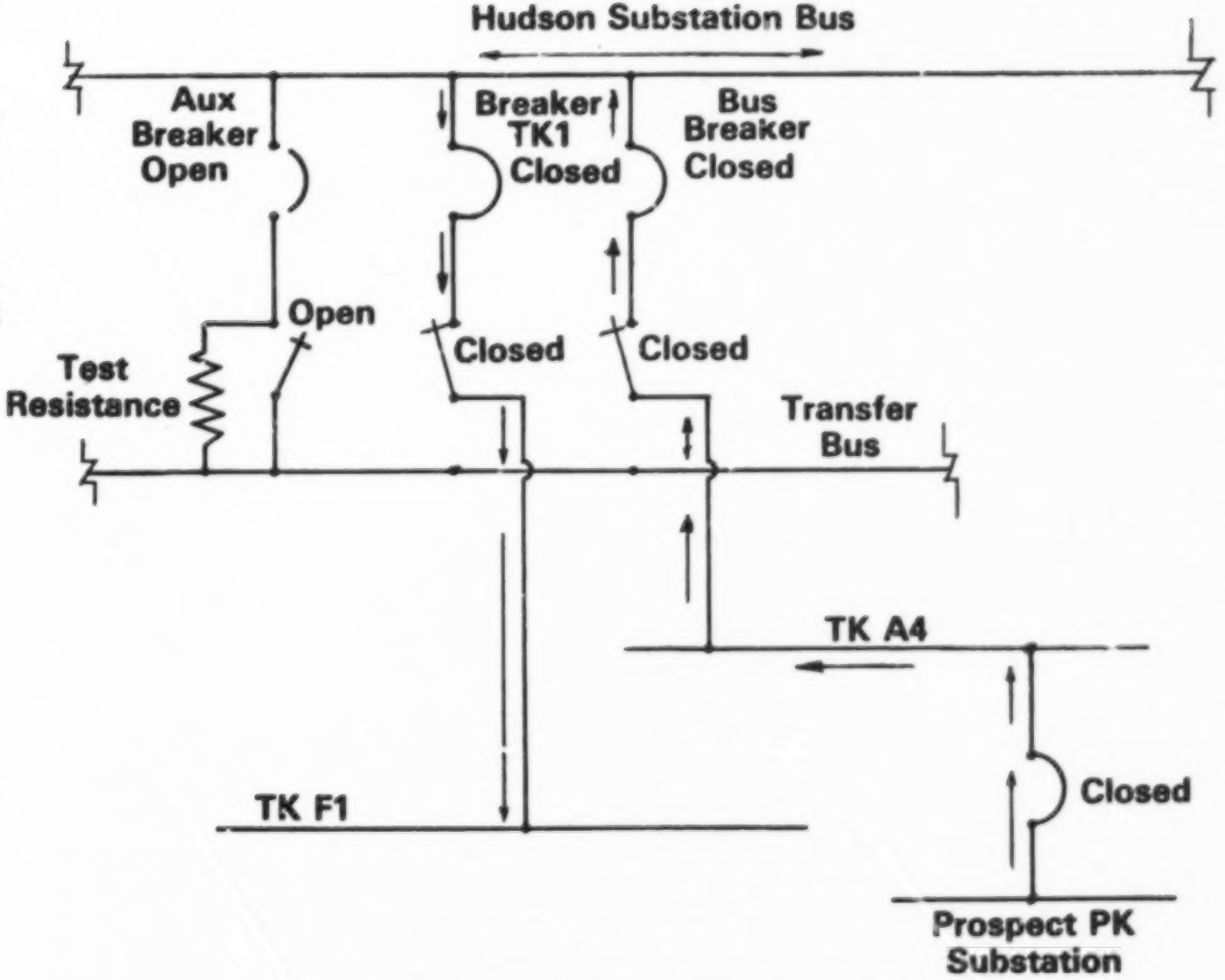

When the train departed the Dekalb Avenue Station About 10:11 a.m.

Figure 8.--Current path.

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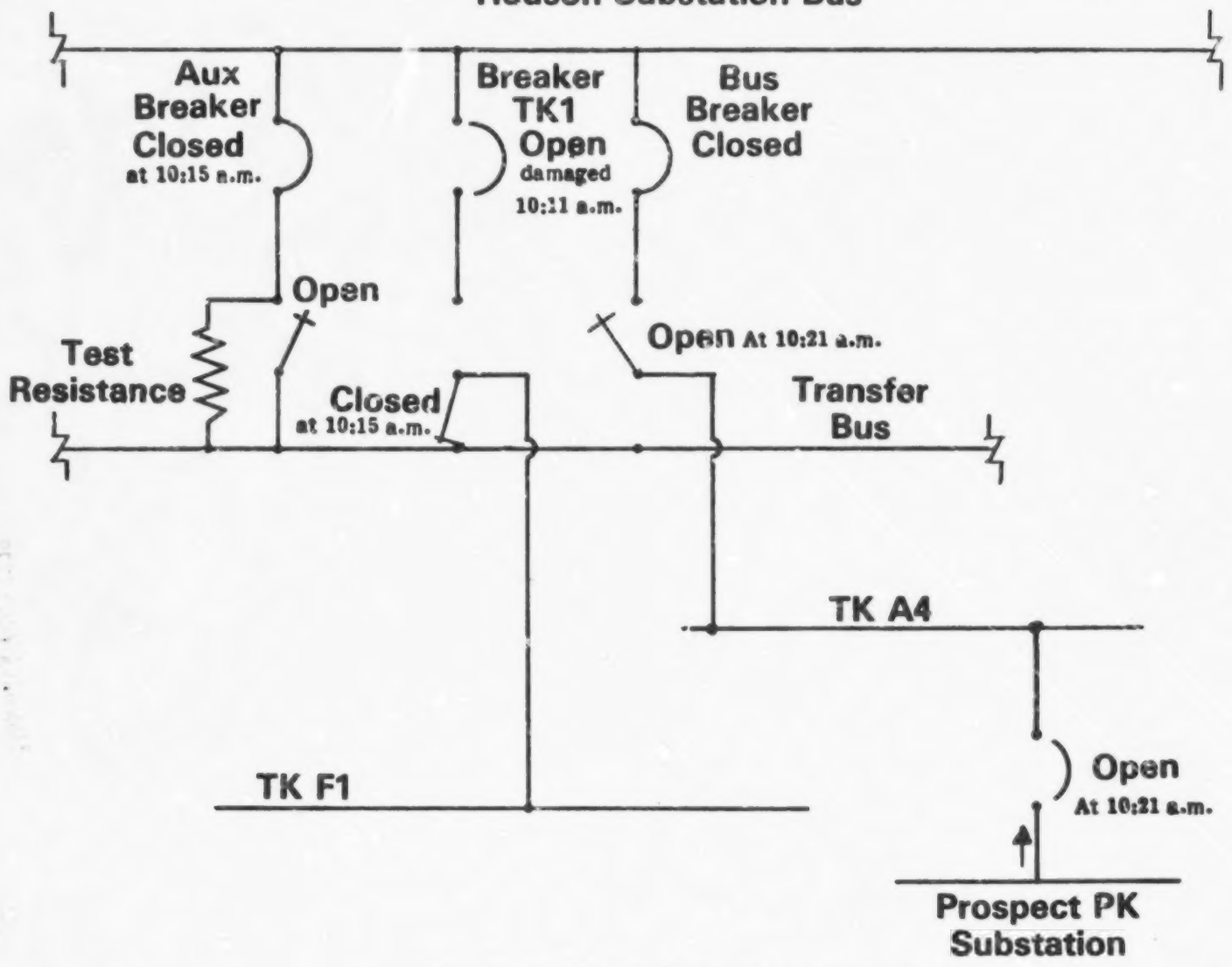

When power maintaine- came on duty at 11 a.m.

Figure 9.--Current path.

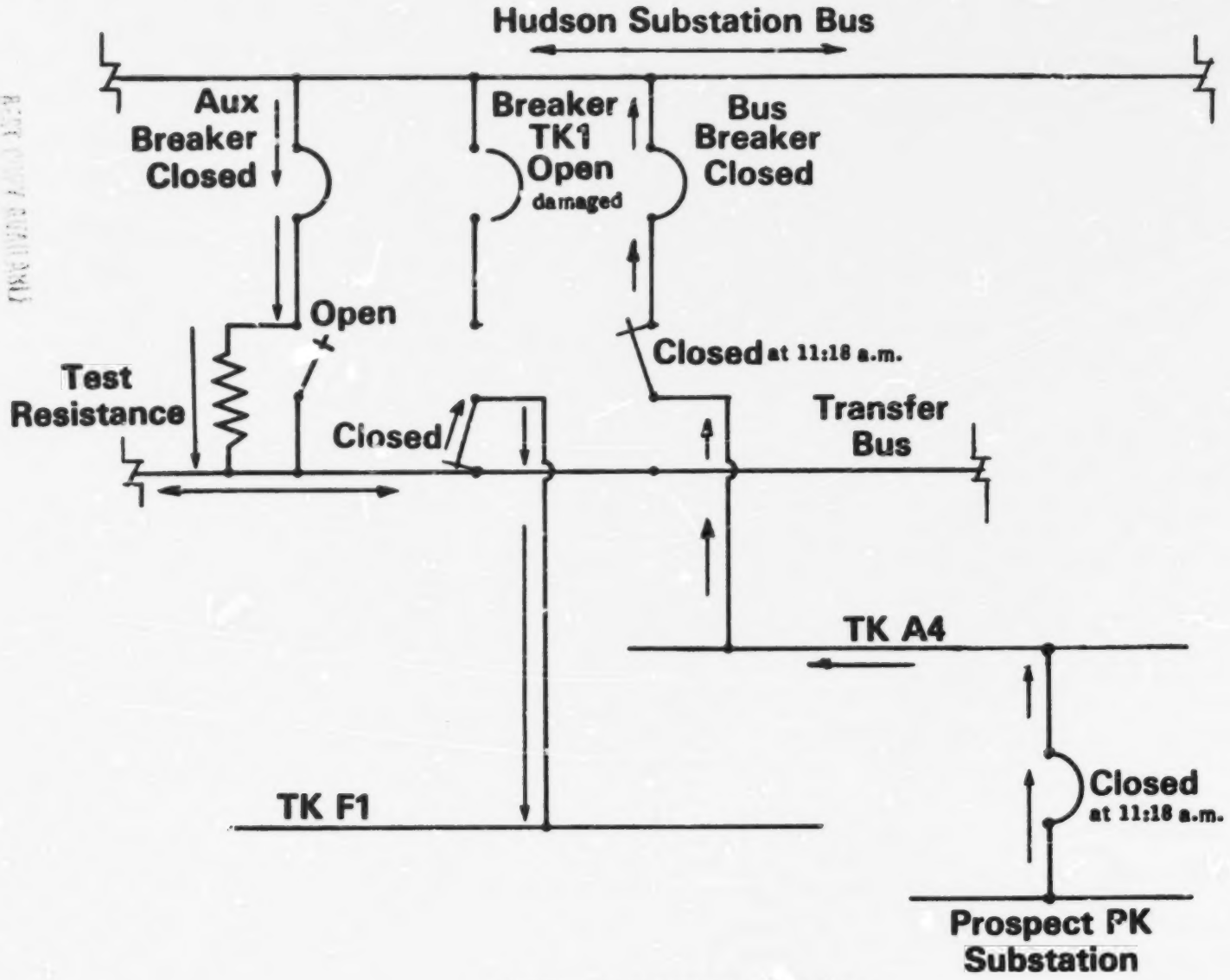

Figure 10.--Current path.

illegible. He also stated that he did not feel confident that he was qualified to operate the Hudson substation and that his training to operate the substation had not been adequate. He had not signed the NYCTA form to qualify at the Hudson substation.

The assistant supervisor had 30 years of experience in the power department and had worked at the Hudson Substation as a power maintainer. He stated that he knew the power maintainer on duty was not qualified. He was concerned because the maintainer had not worked at the substation before as a helper and had only worked on the IND line. He said that he thought the power maintainer should have had 2 to 3 weeks more training. The assistant supervisor stated that he had expressed his concerns to his supervisor and that the power department was attempting to hasten the training process, but that "you can't really do it." He said that he believed the power maintainer, although not fully qualified, was being used to save money so that other fully qualified power maintainers would not have to be brought in on an overtime basis. He further stated that he believed he had some responsibility for the training of power maintainers if he was available and had the time.

Whenever an auxiliary breaker is in use at a substation, the activation of an emergency alarm from a track receiving third-rail power through the auxiliary breaker will not cause an automatic shutdown of third-rail power. It is necessary that the power maintainer on duty at the substation be able to recognize that a legitimate code has been received and then he must physically disconnect the auxiliary breaker.

Third-rail electrical breakers also are located along the tracks so that a breaker can be opened near an area experiencing a power problem or accident. The system is designed so that these breakers must be opened by the power maintainer on duty in the substation. The power maintainer said that he was aware of incidents in which a track breaker had been opened by a power maintainer and that an individual at the site would block the breaker open to avoid accidental reenergizing.

Signal Information

The crossover switch at the derailment site is equipped with a General Railway Signal Company (GRS) model five electric switch machine, which is designed for left-hand operation. A GRS model seven Form B controller box is used in conjunction with the switch machine to detect the switch point position. Switch repeater relays operate in series from contacts within the machine and the circuit controller box to indicate that the switch is locked and the point is properly placed against the stock rail.

NYCTA instructions require that for proper adjustment of the switch machine and circuit controller box, the following must be done:

> Switch locking adjustment - All switch lock rods are to be adjusted to prevent the locking of the switch machine while the standard 1/4 inch fouling gauge is positioned between the switch point and the stock rail 6 inches back from the tip of the point rail. Signal Maintainers must check these adjustments and readjust, if necessary.
>
> Switch circuit controller - Normal and reverse switch contacts must be adjusted while the 1/4-inch switch fouling gauge is positioned between the switch point and the stock rail 6 inches back from the tip. This assures that the controller contacts are open and the switch repeater relays are in the de-energized position.

The NYCTA rules require that a signal maintainer be present when any work is being performed on track that has signal equipment attached. The signal maintainer is to adjust the signal appurtenances to maintain signal integrity.

Emergency Response

At 10:15 a.m., the NYCTA command center notified the NYFD dispatcher in Brooklyn via a direct telephone line. The fire dispatcher activated an alarm at 10:16 a.m. The NYFD responded to the scene with four engine companies, three ladder companies, two rescue units, one squad, and one field command unit. Command officers responding to the scene included one assistant fire commissioner, one assistant chief, one deputy assistant chief, two division chiefs, and two battalion chiefs. A division chief was in operational command.

The first firefighters at the scene proceeded to the disabled train and applied extinguishant to the fire with a hand-held extinguisher. Other firefighters proceeded to stretch hose lengths from the DeKalb Avenue Station through the cars of the train to the fire location; 13 lengths of hose were required. Firefighters then extinguished the fire in the undercarriage of the second car. Other NYFD personnel assisted in evacuating passengers from the first car.

The NYFD reported 49 passengers were treated at the scene by Emergency Medical Services and released; 1 elderly passenger was transported to the Long Island College Hospital, treated, and released; 13 passengers were treated and released at other local hospitals; and 2 passengers were admitted to the Brooklyn Hospital and kept for observation. Seven NYCTA employees received minor injuries.

ANALYSIS

The Derailment

The investigation revealed that the stock rail in the replaced rail sections involving the switch of the crossover had not been seated properly when it was replaced in the old tie plates. Also, the west stock rail braces were loose, two west stock rail braces were missing, and two spikes were missing on the gauge side of the rail. Each of these conditions allowed the loose stock rail to move as several trains traveled through the crossover and on the straight normal route so that the stock rail took a set and was sitting on top of the tie plate risers and would not reseat in the tie plates because of the set. Because of the position of the stock rail, a gap was created between the switch point and the stock rail which exposed the switch point so that the worn wheel of the second car in the accident train struck the switch point and derailed. If either the capital improvement division foreman or the track maintenance foreman had waited to observe the first train over the replaced track, the loose condition of the stock rail would have been noted and corrections could have been made, thus avoiding the accident.

The Safety Board believes that it is unreasonable for the NYCTA management to leave the determination to observe the first train over an area of track where work has been performed on a case-by-case basis to the discretion of those having performed the work. The required observation of the first train following the work done by the capital improvement forces at the switch should not have been considered discretionary by the chief engineer, but should have been absolutely mandatory as prescribed by the NYCTA rule. The Safety Board believes that a strictly enforced requirement as prescribed by the NYCTA rule for observing the first train over renewed track work is just as necessary as

competent inspection of the track work. Competent inspections obviously were not performed in this instance. Had competent inspections been performed, the inadequately performed track work would have been discovered.

In its investigation of a train derailment on March 17, 1984, in the Joralemon Street Tunnel, 3/ the Safety Board learned that no one was present at the work site when the first train passed over the track following the work even though the NYCTA employee responsible to watch the train over the track work area was in the station 1,000 feet away from the accident site. The Safety Board believes that the requirement for observing trains pass over track where work recently has been performed should be strictly enforced so that NYCTA employees responsible for signal and track work will perform such observations when required.

Based on their testimony, there was no clear understanding between the line supervisor and the track maintenance foreman as to who was responsible to inspect, report, and observe trains over the replaced rails. The two deputy superintendents who had arranged for the capital improvement division crew to perform the track work should have instructed the personnel in their divisions as to who was responsible for each part of the assignment. Because no such understanding existed, no one felt responsible to watch the first train over the replaced track, and thus, no one noted the loose condition of the stock rail. The Safety Board believes that, since the capital improvement work force which performed the track replacement was assisting the Track Maintenance Division and had no part in planning the job or ordering and delivering the material to the work site, the responsibility for the oversight to require that the work performed was satisfactory and in accordance with NYCTA standards rested with the superintendent of the Track Maintenance Division.

During its investigation of the Joralemon Street Tunnel derailment, the Safety Board issued Safety Recommendation R-84-19 on April 9, 1984, which recommended that the NYCTA:

> Require that inspectors responsible for insuring safe conditions of track know the necessary standards for maintaining those conditions.

On December 4, 1984, the NYCTA responded that its Rapid Transit Training Division has developed training courses for improving the expertise of track inspectors and track construction engineers and provides an intensive training program for "new" track inspectors. Based on those comments, the Safety Board on April 23, 1985, placed Safety Recommendation R-84-19 in an "Open--Acceptable Action" status. However, up until the time of the accident, neither the line supervisor nor the deputy superintendent had received this training. The May 15, 1985, accident demonstrated that there remain serious shortcomings, such as the lack of a competent track inspection by the line supervisor and the deputy superintendent and the lack of adequate track inspections conducted on the NYCTA. Therefore, the Safety Board reiterates Safety Recommendation R-84-19 and requests that the NYCTA give the recommendation its immediate attention.

The Safety Board's investigation of the Joralemon Street Tunnel accident also revealed a lack of coordination between divisions within the NYCTA Track and Structures Department. The Safety Board's report of the investigation stated:

3/ Railroad Accident Report--"Derailment of New York City Transit Authority Subway Train in the Joralemon Street Tunnel, New York, New York, March 17, 1984" (NTSB/RAR-85/07).

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The coordination between the Engineering and Construction Department, which was providing the contract inspectors, and the Track and Structures Department, which was responsible for track safety, was practically nonexistent in this case.

Following the Joralemon Street Tunnel accident, the NYCTA attempted to correct the lack of coordination by consolidating the Engineering and Construction Department and the Track and Structures Department. However, at the time of the May 15, 1985, derailment, NYCTA's consolidation of both departments under one head had not yet accomplished the desired result. In this accident, the crew that performed the track work did not find sufficient stock rail braces at the work site; consequently, three braces were not installed on the rail involved in the accident. There was a breakdown in departmental followup when the track maintenance forces did not insure that the necessary material was in place. When the capital improvement crew arrived at the job site, it had no means to transport material to the site. Also, there was an equal breakdown in departmental procedures when the line supervisor left the job site, indicating that it was ready for train movements, when, in fact, material was missing from the track. The lack of coordination among NYCTA departments involved in the track work probably contributed to the line supervisor not informing anyone about the missing material and the failure of the two deputy superintendents to have a thorough understanding as to who was performing each part of the assignment. The Safety Board believes that the lack of coordination that was demonstrated in the Joralemon Street Tunnel accident had not been sufficiently resolved by NYCTA management at the time of the May 15, 1985, accident.

It is absolutely necessary to gauge and align rail when it is being installed. Failure to gauge rail when it is being installed assumes that the rail was properly installed when previously laid and maintained at a proper gauge until replaced. To operate trains on track where such assumptions are made exposes passengers to a needless risk. When installing rail in old tie plates, it is necessary to compensate for wear on the head of the rail because the gauge widens as wear increases. Also, tie plates may have moved because of the dynamic action of train movement on the track, and tie plate cutting of the wooden ties often results in canting of the rail. To place new rail in old tie plates without realigning the track can result in improper gauge of the track. The action of the line supervisor of the capital improvement division in leaving the work site without gauging and aligning the track and reporting to the track foreman of the maintenance division that the work was completed demonstrates that the line supervisor was inadequately trained and supervised. Although the Chief Engineer Track and Structures identified the problem of seating new rail in existing tie plates, it cannot be assumed that a line supervisor would gain this knowledge from working on track. Neither the track training manuals nor the track maintenance standards manual provides any instructions that extra precautions be taken when laying new rail in existing tie plates, or the procedure to use to determine if the new rail is properly seated. The NYCTA should expedite the development and dissemination of the new track standards manual and immediately instruct all employees responsible for track maintenance in utilizing those standards.

Failure to properly tighten and lock the stock rail braces and failure to properly gauge the track allowed the stock rail to cant, allowed the gauge to widen and move away from the switch point, and permitted the wheel to strike the switch point. Not only did the line supervisor fail to properly supervise his track personnel and conduct a thorough inspection, but his supervisor, the deputy superintendent, failed to detect the loose stock rail braces during his inspection of the track site. Both the actions of the line supervisor and the deputy superintendent indicate that the management oversight of the employees and supervisors is inadequate.

Train Information

The No. 7 wheel, the lead wheel on the right side of the second car, had a flat surface on the flange. Thus, it had a greater opportunity to strike and go over the switch point than if it had been more rounded. The amount of wear on the wheel could not have occurred during the derailment but probably occurred over a period of time before the derailment. The brake rigging must have been binding and holding the brake shoe against the wheel as indicated by the brake material being worn off and the steel backing plate contacting the wheel. This steel backing plate in contact with the wheel caused the wearing away of the flange of the wheel and created the flat surface on the flange. This flat surface struck the exposed switch point and went up and over the switch point and derailed. Had the wheel had a more rounded surface, as did the wheels of the first car, it is possible that it would have pushed the switch point against the stock rail and followed the first car into the crossover. However, because of the loose condition of the stock rail, a derailment eventually would have occurred even if the wheel of a car showed no wear.

There are no industry standards to determine the minimum height or the minimum radius to keep wheels in service. This wear problem is limited to those companies that use brake shoes that contact the flange of the wheel. Most rail systems use brake shoes that contact the wheel tread only. Therefore, the NYCTA should establish wear limits for the removal of wheels when the top of the flange becomes worn.

Signal Equipment

The signal maintainer stated that he made all the necessary adjustments to the signal system at the crossover location while the track work was being conducted. However, evidence indicates that the signal maintainer did not adjust the switch point throw rods properly to meet the switch throw travel and that the stock rail moved away from the stock rail, causing a gap between the switch point and the stock rail which caused the signal to continue to display a proceed indication.

When signal equipment is properly adjusted, it provides the protection necessary for safe train operation. However, train operators must depend on and place great confidence in the signal system. The 3 3/4-inch switch point throw for the normal switch point position and the 4-inch reverse switch point throw found after the accident indicated that the signal maintainer had not adjusted the switch point position throw by closing the point 1/8 inch and that he left the switch point open before adjusting the reverse lock rod. This accident and other accidents investigated by the Safety Board indicate that the NYCTA is not adequately supervising its employees and is allowing them to use improper procedures for inspection and maintenance of its signal system.

Emergency Response

Following a Safety Board special investigation of NYCTA subway fires, 4/ the NYCTA and the NYFD met and made new criteria for reporting emergencies and have been developing guidelines for evacuation of passengers and other problems NYCTA has experienced in accidents. The emergency response was prompt in this accident; the NYCTA command center reported the incident to the NYFD by a direct telephone connection and the NYFD was at the accident site within 5 minutes with a full team of firefighters, officers, and a division chief in command.

4/ Special Investigation Report--"New York City Transit Authority Subway System Fires" (NTSB/SIR-85/04).

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Even though communications were not possible because of damage to the second car in the train the conductor of the derailed train, was able to move the passengers quickly and without panic to the rear cars in the train and discharge them to the DeKalb Avenue station platform.

When the six trains became stalled in the tunnels and on the Manhattan Bridge, the NYFD, together with the NYCTA, was able to dispatch sufficient personnel to each train to handle the evacuation of passengers in an orderly and prompt manner. Also, following the loss of third-rail power, the NYCTA immediately broadcast to trains, through the public address system, information regarding the power shutdown and that rescue personnel were en route to the trains. The evacuation was well executed, and no injuries occurred during the evacuation. Both the NYFD and the NYCTA are to be commended for the prompt and orderly manner in which this evacuation of passengers was conducted from trains in a 3 1/2-mile area.

Emergency Procedures

As a result of the Safety Board's special investigation of subway fires on the NYCTA in December 1984, the Safety Board recommended that the NYCTA:

> Immediately establish a safe procedure for the New York Fire Department to use in an emergency to remove the third-rail power on the subway system, and disseminate the procedure to all affected parties. (Class II, Priority Action) (R-85-30)

The NYCTA responded on May 16, 1985, that such a procedure exists and that it is reinforced as part of on-going interagency training. The Board pointed out in its November 8, 1985, response that, as the special investigation revealed, the NYFD was unaware that in those instances where fire department personnel removed third-rail power at the scene of an incident, third-rail power would be restored by the NYCTA command center within 4 minutes unless further communication was received from the area. Consequently Safety Recommendation R-85-30 is being held in an "Open-Unacceptable Action" status pending NYCTA's resolution of this problem.

This accident revealed other problems in third-rail shutdown, such as an inability for power maintainers to easily identify the circuit schematics on substation equipment panels and, when an auxiliary breaker is in use at a substation, the activation of an emergency alarm from a track receiving third-rail power through the auxiliary breaker will not cause an automatic shutdown of third-rail power. Many individuals working for the NYCTA and around the third rail do not understand this latter shutdown feature in the system and do not realize that a delay can occur while the power maintainer disconnects the auxiliary breaker. This delay could be very dangerous for an individual assuming that power is off when it is not.

Also, during the investigation Safety Board investigators learned that there have been incidents where a track breaker had been opened by a power maintainer and that it was blocked open by an individual at the site to avoid accidental reenergizing as it occurred in this accident. If the blocking of track breakers was an enforced procedure on the NYCTA, this accidental reenergizing, which created a life-threatening situation, would not have occurred. The circumstances of this accident and the improper understanding of the NYFD in the December 1984 special investigation demonstrate a need for the NYCTA to review the entire process of shutting down and restoring third-rail power and for providing protection for individuals working around the third rail.

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Management Oversight

A potentially dangerous situation developed when power was restored to the third rail on track No. F1 at the accident site before the derailed car had been rerailed and while NYCTA personnel where at the derailed train. The incident occurred because the power maintainer at the Hudson substation did not know that the substation's auxiliary breaker had a unique resistance loop through which power would be restored to the southbound tracks when power was restored to the northbound tracks. Both the power maintainer and his supervisor were aware that the power maintainer had not been adequately trained, that he was unprepared for the demands of the job, and that he needed additional training. For the NYCTA management to allow the power maintainer to fill such a responsible position without the necessary training and supervision was inexcusable. The assistant supervisor at the Hudson Station knew the power maintainer needed more training and acknowledged he had some responsibility for training. Nevertheless, although the assistant supervisor was present when the auxilary breaker was closed, he did not inquire about the instructions the power maintainer had received from the system operator or accompany him when he went to restore power. If the assistant supervisor had done so, he probably would have seen that track No. F1 would be energized through the test resistance loop and he would have taken action to prevent the track from being energized.

NYCTA management has taken action to discipline the track foreman, the signal maintainer, and the power maintainer for the improper practices that were used in the replacement of the track, the adjustment of the signal system, and the energizing of the third rail at the accident site when the intent was to energize only the northbound tracks. So many failures by employees to properly perform their job tasks indicate that the NYCTA management has failed to properly supervise employees in their duties, especially since (1) before the derailment, a deputy superintendent of the track department had inspected the track and had taken no exception to the work that had been done, (2) an assistant supervisor of the power department, who was present at the substation, understood that the power maintainer was not fully qualified, but yet did not monitor the activities of the maintainer, and (3) there was a lack of qualified power maintenance personnel to man the substation. Until NYCTA management accepts responsibility for the quality of employee performance necessary to operate the NYCTA system in a safe and reliable manner, situations such as those that developed in this accident will continue to develop and may result in more accidents.

The lack of supervision of NYCTA employees has been noted in previous accidents investigated by the Safety Board. In its special investigation report of September 22, 1981, involving eight subway fires on the NYCTA, 5/ the Safety Board stated, in part:

> . . . without . . . increased surveillance and quality control, the performance and effectiveness of the maintenance program is not likely to improve significantly.

In its report of the Joralemon Street Tunnel derailment, the Safety Board stated,

> . . . evidence does not explain how or why procedures had become so lax that train operators and their supervisors passed the improperly installed and missing slow signs numerous times without reporting the deficiencies . . . This accident and the previous accidents indicate that lack of training and supervision of employees is not limited to only one department but pervades the NYCTA system.

5/ Special Investigation Report--"Eight Subway Fires on New York City Transit Authority with Evacuation of Passengers" (NTSB/SIR-81/5).

Inadequate supervision was demonstrated in this accident and indicates that poor management oversight extends throughout the NYCTA. In the 1981 report on eight subway fires, the mechanical department was noted to lack competent supervision; in the Joralemon Street Tunnel derailment, it was the operating department; and in this accident, it was the track, signal, and power departments that had problems with lack of adequate supervision that resulted in the derailment and in the inadvertent energizing of the third rail at the accident site. Throughout these accidents, the undetected poor workmanship by the individuals involved was the result of poor supervision.

Top executives of the NYCTA have taken some action to correct management and supervisor performance. The Car Equipment Department management has been reorganized, and the Department of Track Construction and Track Maintenance has been combined with the Track and Structures Department. These changes were made to improve communications and to provide a more efficient management structure. Also, the Safety Department was elevated to a level that reports directly to the Chief Operating Officer. However, at the time of this accident, the management reorganization had not made a significant change at the worker level.

Training

The lack of adequately trained NYCTA employees had been noted in previous accidents and special investigations. At the Safety Board's public hearing on Rail Rapid Transit Safety in July 1980, an NYCTA motorman testified:

> NYCTA has never provided adequate emergency training to employees . . . that NYCTA has emergency procedures on paper, but that employees receive no hands-on training.

At the same hearing, a representative of NYCTA management testified:

> The success of any operation depends on the skilled, trained people that we have. The best developed procedures are just so much paper if the personnel that must apply them do not do it effectively.

In the special investigation of eight subway fires in 1980 and 1981, the Safety Board noted the shortcomings of motormen and conductors to respond to emergencies. As a result of that special investigation, the Safety Board recommends that the NYCTA:

> In conducting "hands on" training of employees for responding to emergencies, assign top priority to the training of motormen and conductors. (Class I, Urgent Action) (R-81-106)

> Provide training to motormen and conductors to enable them to evaluate emergencies, communicate vital information immediately to appropriate authorities, and ascertain when conditions require the immediate evacuation of passengers. (Class II, Priority Action) (R-81-107)

Following an indication from the NYCTA that operating personnel, particularly motormen and conductors, were being trained to be familiar with and respond to a fire situation and to evacuate passengers during emergency situations, the Board ultimately placed Safety Recommendation R-81-107 in a "Closed--Acceptable Action" status on

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May 29, 1984. According to the NYCTA, this training included refresher courses on standard operating procedures, safety sessions, and a film tailored to teach employees emergency procedures they would be expected to carry out. Because it was concerned, however, that the "hands on" training was not proceeding as quickly as it could, the Board urged the NYCTA to revise its schedule for training. The NYCTA stated that it reviewed and consequently revised its schedule for "hands on" training and indicated in a September 5, 1985, letter that by the end of 1986 over 1,900 operators and conductors will have received "hands on" training. Based on these indications, the Board placed Safety Recommendation R-81-106 in a "Closed--Acceptable Action" status. In this accident, however, the train operator (motorman) stated that he had not been to the NYCTA school for firefighting and that he could not make the decision to evacuate passengers because only command center or supervisory personnel could make that decision.

In a report of an accident involving the rear-end collision of two NYCTA trains on July 3, 1981, 6/ the Safety Board made the following statement:

> The Safety Board believes that the NYCTA should immediately review the events of this accident and establish training and operating procedures to avoid the confusion and conflicting instructions in future situations of this type.

Also, the Safety Board recommended that the NYCTA:

> Train operating department personnel in the differences between the two train control systems used on the New York City Transit Authority System. (Class II, Priority Action) (R-82-35)

Safety Recommendation R-82-35 is currently being held in an "Open--Acceptable Action" status pending receipt of information on the number of operators who have to date received this training.

In the Joralemon Street Tunnel derailment, track inspectors were identified as requiring training. In September 1981, following the special investigation of NYCTA equipment department training, the Safety Board recommended that the NYCTA:

> Establish a systemwide program of initial and recurrent training for car repairmen, car inspectors, maintenance foreman, and quality assurance personnel. (Class II, Priority Action) (R-81-103)

The NYCTA developed such a training program, and the Safety Board ultimately placed Safety Recommendation R-81-103 in a "Closed--Acceptable Action" status on May 29, 1984. In December 1984, during its special investigation of NYCTA subway fires, the Safety Board reviewed the program further, found it to be thorough, and concluded that the program was an excellent effort by the NYCTA management to bring the training for the equipment department personnel up to a level necessary for the employees to be able to perform the work on cars in a satisfactory manner.

The Safety Board believes that the May 15, 1985, accident, like the previous accidents referred to, demonstrates the continuing failure of the NYCTA management to understand the critical importance to safety of such factors as adequate staffing and shift

6/ Railroad Accident Report--"Rear-end Collision of New York City Transit Authority Subway Trains 142NL and 132NL, Brooklyn, New York, July 3, 1981" (NTSB/RAR-82/02).

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scheduling, formal classroom and on-the-job training programs, evaluation of personnel qualifications and experience, emergency procedures and drills, and close review and assessment of supervisory and organizational functions. Apparently, the lessons of past accidents that have been embodied in many Safety Recommendations to the NYCTA have not been sufficient to produce a "top-down" management commitment to improving safety of operations and maintenance through a systematic review and analysis of its training, staff, supervisory, and inspection requirements. Furthermore, where training programs and procedures have been developed in response to previous Safety Recommendations, it appears that the new programs have been poorly implemented with little assessment of their effectiveness and no assurance that all employees needing training will receive it in a timely fashion. In the May 15 accident, the train operator, with 14 years of experience operating trains, had not received any training in firefighting and did not understand his responsibility for the evacuation of passengers. This accident also demonstrated that the line supervisor and deputy superintendent did not make a competent track inspection of the work performed. The line supervisor did not bring a track gauge to the job site, and he did not gauge or align the replaced track. The power maintainer, because of his lack of experience as a helper in manual substations, could not answer the questions on the examination that pertained to manually-operated substations. After failing the examination twice, he asked questions in order to be able to answer the examination questions and successfully passed the examination on the third try without any practical experience or training. He had received only on-the-job training and was unqualified to be a power maintainer at the Hudson substation. Since the foreman, who normally would have conducted the on-the-job training of this power maintainer, had been on leave and his position had not been filled for several months, the few occasions in which the power maintainer was given the opportunity to observe one of the two regular Hudson substation power maintainers at work on their respective 12-hour shifts hardly qualifies to be called an "on-the-job" training program.

State Oversight

On May 1, 1984, the New York State Public Transportation Safety Board (NYSPTSB) was established as an independent agency within the State of New York with the specific responsibility for overseeing the safety of local public transportation. The Board has long believed that rail rapid transit safety is primarily a local responsibility that is best handled by the State and local decisionmakers and issued a recommendation in 1981 to the State of New York to that effect. The Board believes that the inadequate supervision of employees and the inadequate training of employees that has been revealed as a result of the May 15 accident investigation, previous accident investigations, and special studies are areas of concern that the NYSPTSB should immediately address. Moreover, the Safety Board is aware that the NYSPTSB, in exercising its role as overseer of rail rapid transit safety, has required the NYCTA to submit a safety plan for approval. The Safety Board has been informed that, based on a preliminary review of the plan, the NYSPTSB does not consider the plan satisfactory. The Safety Board believes that as part of its ongoing review of the NYCTA safety plan, the NYSPTSB should require the NYCTA to include in its safety plan an outline of training programs for all operating personnel and an outline of the supervisory and management structure of the NYCTA system for all departments.

CONCLUSIONS

Findings

1. The crewmembers of the train were qualified to operate the train under NYCTA rules.

2. The replacement of rail in the old tie plates without gauging or aligning track caused irregular gauge and unstable track that were present due to wear in the old track to be transferred to the new track

3. The renewed stock rail of the crossover switch was not secured in compliance with NYCTA requirements.

4. If the rail had been properly aligned and secured, it would have supported the movement of the train through the crossover.

5. The deputy superintendent who inspected the track following the completion of the rail replacement took no exception to the work that had been done.

6. No one was at the site of the rail replacement when the first train passed as required by NYCTA rules.

7. Revenue trains were authorized to operate through the crossover at authorized speed without restrictions after the general order was lifted by the track foreman in the maintenance division.

8. The flat surface on the worn wheel of the second car struck the exposed switch point and went up over the switch point and derailed.

9. Although the NYCTA had documented standards for replacement of rails, these standards had not been complied with at the accident site.

10. The maintenance work performed by the track crew was not adequately supervised by NYCTA management.

11. The NYCTA had documented standards for adjusting the signals.

12. The signal system at the crossover was not adjusted properly when the rail was replaced, so when the train approached, a proper diverging signal was displayed with the right switch point gapped open.

13. The power maintainer was not qualified to operate the manual substation.

14. The assistant supervisor did not monitor the activities of the power maintainer even though he knew that the maintainer was not qualified.

15. Because of a lack of legible schematic drawing on the substation panel, a test resistance loop remained connected and allowed the 600-volt, third-rail power to bypass an open knife switch on the auxiliary breaker line and reenergized the third rail at the accident site.

16. The power maintainer at the Hudson substation was not aware of the test resistance loop.

17. The scope of the accident and risk to employees at the accident site were increased when the third-rail power was energized before the emergency was over.

18. The evacuation of passengers was well executed by NYFD and NYCTA personnel.

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19. The NYCTA supervision failed to detect the improper rail conditions and the improper alignment of switches and breakers at the Hudson substation.

20. The NYCTA failed to properly staff the Hudson substation, allowing two regular power maintainers to be placed on 12-hour shifts, and it failed to obtain a replacement for the regular foreman who had been placed on leave for personal injury for several months before the accident.

21. The NYCTA management failed to develop job performance criteria to evaluate the qualifications of personnel assigned to perform critical job functions.

22. The NYCTA management failed to exercise proper management oversight by not clearly delineating the specific duties and responsibilities of its different departments, supervisors, inspectors and other employees and by not establishing a review process to measure the actual performance of those duties and responsibilities by the staff and supervisors.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the New York City Transit Authority's failure to supervise properly the employees replacing rails and adjusting signals to require that the replacement of the rails was in conformity with NYCTA procedures. Contributing to the scope of the accident was the NYCTA's failure to supervise an unqualified power maintainer while restoring third-rail power, which resulted in an inadvertent energizing of the third rail at the accident site before the emergency was over and subsequent third-rail power removal which caused the stopping and evacuation of 16 additional trains.

RECOMMENDATIONS

As a result of its investigation, the National Transportation Safety Board made the following recommendations:

--to the New York City Transit Authority:

Establish and carry out a management review and evaluation program to improve the management control and administrative guidance available to identify and correct deficient staffing, training, procedures, inspection, and supervision in the New York City Transit Authority system. (Class II, Priority Action) (R-86-4)

Establish a standard for determining the wear limit for the top of the wheel flange to prevent wheels continuing in service that have a flat surface on the flange. (Class II, Priority Action) (R-86-5)

Inspect periodically and improve where necessary the condition and legibility of the circuit schematic drawings on the panels of all substations for easy reference by power maintainers. (Class II, Priority Action) (R-86-6)

Review and improve the procedures for management coordination between divisions that are performing comparable functions or joint systemwide programs. (Class II, Priority Action) (R-86-7)

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Expedite the completion of the new track standards manual and instruct all employees responsible for track inspection, maintenance, and replacement in those standards. (Class II, Priority Action) (R-86-8)

--to the New York State Public Transportation Safety Board:

Evaluate the training programs of all track, signal, and operating personnel to determine if they are adequate to provide for the safe operations of trains, and require the New York City Transit Authority to institute the necessary changes. (Class III, Longer-Term Action) (R-86-9)

Require the New York City Transit Authority to include in the safety plan submitted to the New York State Public Transportation Safety Board its program for training employees involved in train operations. (Class II, Priority Action) (R-86-10)

Evaluate the supervision of New York City Transit Authority employees to determine if the supervision is adequate to assure that work performed is in accordance with New York City Transit Authority rules and procedures. (Class III, Longer-Term Action) (R-86-11)

Require the New York City Transit Authority to include in the safety plan submitted to the New York State Public Transportation Safety Board its programs for improving management coordination between departments that are performing comparable functions or joint systemwide programs. (Class II, Priority Action) (R-86-12)

In addition, the National Transportation Safety Board reiterated Safety Recommendation R-84-19 issued on April 9, 1984, and Safety Recommendation R-85-30 issued on March 29, 1985, to the New York City Transit Authority:

Require that inspectors responsible for insuring safe conditions of track know the necessary standards for maintaining those conditions. (Class II, Priority Action) (R-84-19)

Immediately establish a safe procedure for the New York Fire Department to use in an emergency to remove the third-rail power on the subway system, and disseminate the procedure to all affected parties. (Class II, Priority Action) (R-85-30)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ JOHN K. LAUBER
Member

March 27, 1986

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APPENDIX A

INVESTIGATION

The National Transportation Safety Board was notified of the accident at 11 a.m., on May 15, 1985. The Safety Board immediately dispatched investigators from the field offices at New York and Fort Worth, Texas, and from the Washington, D.C., office to tne accident site.

Groups were formed to investigate track and signal factors, mechanical factors, operations factors, and survival factors. The Safety Board was assisted in its investigation by representatives of the parties which included the New York City Transit Authority, the New York State Public Transportation Safety Board, and the Transport Workers Union of America.

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APPENDIX B

PERSONNEL INFORMATION

Train Operator

Mr. Sterling Burton had been employed by the NYCTA for 16 years. He started his employment as a bus operator, a position he held for 2 years. He took classroom and on-the-job training for 11 months and then took the test for train operator and successfully passed. Mr. Burton had been employed as a train operator for 14 years. He had not had any firefighting training but had received classroom training on passenger evacuation and new car equipment. He was qualified under NYCTA rules without restriction.

Train Conductor

Mr. Roy Merseles had been employed by the NYCTA for 15 years. He started his employment as a railroad porter, a position he held for 3 years. He then entered a month-long training program for conductors that involved classroom training and riding trains with qualified conductors. Following the training program, Mr. Merseles successfully completed an examination for promotion. He had worked as a conductor for 12 years. He had attended a refresher course several years before the accident for rules and regulations of the NYCTA. He had not received any firefighting training, but he had received training in passenger evacuation. He was qualified under NYCTA rules without restriction.

Student Conductor

Mr. Anthony Davis had been employed by the NYCTA for 17 months. He started his employment as a conductor, and after 6 weeks of classroom and on-the-job training, he took and successfully completed the conductor's examination for promotion. During his training, he received 1 day training in firefighting techniques and 1 day training in panic control techniques. On the day of the accident, Mr. Davis was in transition for another division and was riding the train to become familiar with the route. At the time of the derailment, he was performing the duties of the conductor. He was qualified as a conductor but not on the N line.

Line Supervisor

Mr. Lance Mitnick had been employed by the NYCTA for 15 1/2 years. He started his employment as a car cleaner. He worked 6 years as a trackman and 6 years as a line supervisor of track. Before becoming a line supervisor, he received classroom and on-the-job training for 3 months; each day of the training he was required to pass a test for that day's instructions. Following the training, Mr. Mitnick successfully completed an examination for promotion. He had not received any refresher courses in the 6 years he had worked as a line supervisor; however he is qualified under the NYCTA rules.

Deputy Superintendent Track

Mr. Alfonse Wojcih had been employed by the NYCTA for 11 1/2 years. He began his employment as a track worker and continued in that position for 7 years. He was promoted to track foreman and worked in that assignment for 4 years. At the time of the accident, he had been working as deputy superintendent for 6 months. He attended

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training classes for 3 months before he was appointed as a track foreman. Mr. Wojcih did not receive any additional training when he was promoted to deputy superintendent. He was qualified under NYCTA rules.

Signal Maintainer

Mr. Franklin Orrace had been employed by the NYCTA for 11 years. He began his employment as a signal helper and worked in that assignment for 8 years. He then took training for the position of signal maintainer, which included 3 months of classroom and 3 months of on-the-job training. At the time of the accident, Mr. Orrace was finishing a 3-year probationary period. He was qualified under NYCTA rules.

Power Maintainer

Mr. Dominick Tyson had been employed by the NYCTA for 12 years. He had begun his employment as a maintainer's helper and had worked at that assignment for 11 years. As a maintainer's helper, he had cleaned and repaired equipment in automatic substations under the direction of a power maintainer. He attempted twice to take the qualifying examination for the position of power maintainer but, because of his limited experience, he was unsuccessful. Mr. Tyson had never worked at a manually-operated substation, and many of the questions on the examination pertained to the operation of a manual substation. He obtained books for study and interviewed experienced power maintainers, and on the third attempt, passed the examination and was promoted to power maintainer. After becoming a power maintainer, he received on-the-job training at each substation to which he was assigned.

At the time of the accident, Mr. Tyson was assigned to relieve power maintainers at any of six substations who were on vacation or on extended sick leave. He received on-the-job training from the employees at each substation, and he was required to sign a form to indicate that he was qualified at each substation. He did not sign a form for the Hudson substation because he felt he was not sufficiently trained in the operation of the Hudson substation and had reported so to his supervisor and to his union.

Assistant Supervisor

Mr. Frank Rachute had been employed by the NYCTA for 30 years. He had been employed by the NYCTA as a maintainer's helper, a power maintainer, a power department foreman, and an assistant supervisor. Mr. Rachute had worked the Hudson substation as a power maintainer. He was qualified under NYCTA rules.

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